



PREPARATORY AND PRE-PLANNING FOR GENEFF PROJECT

Final Report

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Abbreviations

CEA	-	Central Electricity Authority, Ministry of Power, Government of India
ESCO	-	Energy Service Company (Private sector)
LEP	-	Life extension programme
PFC	-	Power Finance Corporation
PLF	-	Plant load factor
PPI	-	Power plant improvement
R & M	-	Renovation & Modernisation
RLA	-	Residual life assessment
SEB	-	State Electricity Board
WB	-	World Bank

Acknowledgement

TERI places on record its sincere thanks to The DEUTSCHE GESELLSCHAFT FUR TECHNISCHE ZUSAMMENARBEIT (GTZ) GmbH, New Delhi for entrusting us with the assignment of collecting relevant information concerning performance of State Electricity Board (SEB) power plants and developing a criteria matrix to assess the suitability of SEB thermal power plants for ESCO involvement vide their Contract No. IGEEP/3/18 (Project No.2000 2148.5-001.00). The contribution and advice of Dr. Albrecht Kaupp, Senior Advisor, GTZ, during the entire course of the project was very valuable and help the project team to shape the study. Our sincere thanks are also due to Mr K C Mahajan, Project Manager, GTZ, for providing his support and expert comments to the project team. The interactive process followed for reviewing the work under different tasks compiled by the TERI team helped in ensuring that the data collected suits the needs of the project.

- The Performance Evaluation Division of CEA also conducts few performance audits every year. Their study is included as a chapter in the CEA's publication.
- The selection criteria of power plants for ESCO involvement are divided into four categories i.e. technical, financial, human resource and others.
- Latest data of physical (technical) performance of power plants is under printing whereas financial performance data up to the year 2000 is available in public domain.
- The physical and financial data of power plants with respect to the criteria matrix is encoded in the Excel spreadsheet and enclosed in this report.

Task I:

List of previous studies about SEB power plants

A. Reports in Public Domain

Title	Authors	Year of publication	Publisher	Avail-ability	Address
1. National perspective plan for renovation & modernisation and life extension of thermal power stations (upto 2011-12)	CEA	June 2000	Electric Power Information Society (Central Electricity Authority)	Yes	Joint Secretary (Admn), Electric Power Information Society, Central Electricity Authority, Sewa Bhavan, R K Puram, New Delhi – 110 066
2. Performance review of thermal power stations 1996-97	CEA	June 1999	Electric Power Information Society (Central Electricity Authority)	Yes	Joint Secretary (Admn), Electric Power Information Society, Central Electricity Authority, Sewa Bhavan, R K Puram, New Delhi – 110 066

Title	Authors	Year of publication	Publisher	Avail-ability	Address
3. Public electricity supply – All India statistics 1997-98: General Review	CEA	August 2000	Electric Power Information Society (Central Electricity Authority)	Yes	Joint Secretary (Admn), Electric Power Information Society, Central Electricity Authority, Sewa Bhavan, R K Puram, New Delhi – 110 066
4. Compendium of Power Generating Plants – July 1997	CEA	July 1997	Electric Power Information Society (Central Electricity Authority)	Yes	Joint Secretary (Admn), Electric Power Information Society, Central Electricity Authority, Sewa Bhavan, R K Puram, New Delhi – 110 066
5. Financial performance review of state electricity boards during 1991-92 to 1994-95	CEA	March 1998	Electric Power Information Society (Central Electricity Authority)	Yes	Joint Secretary (Admn), Electric Power Information Society, Central Electricity Authority, Sewa Bhavan, R K Puram, New Delhi – 110 066
6. Annual report on the working of state electricity boards and electricity departments	Govt. of India	June 2001	Power & Energy Division Planning Commission, Government of India	Yes	http://planningcommission.nic.in

Title	Authors	Year of publication	Publisher	Avail-ability	Address
7. Performance of state electricity boards in India – 1992-93 to 1995-96	CPU	April 1998	Council of Power Utilities	Yes	Council of Power Utilities, A-2/158, Janakpuri New Delhi – 110 058 www.india-power.org
8. The SEB Report 2001	Power Line	2001	Power Line Research	Yes	Power Line Research A Division of India Infrastructure Publishing Pvt Ltd D-4/5, Second Floor Vasant Vihar New Delhi – 110 057
9. International Conference and Business Meet on Optimisation of existing capacity (R&M) – 14 to 15 February 2002, Kolkata (2 volumes)	CIL, BHEL, PFC	2002	Confederation of Indian Industry	Procured for Rs 1500/-	Confederation of Indian Industry, Gate No 31, North Block, Jawaharlal Nehru Stadium, New Delhi – 110 003
10. Profile or power utilities and non-utilities in India 2000	CPU	2000	Council of Power Utilities	Yes	Council of Power Utilities, A-2/158, Janakpuri New Delhi – 110 058 www.india-power.org

B. Studies conducted; reports not in public domain

1. USAID/NTPC LEP studies for Chandrapur (DVC) and Nasik
2. LEP studies and R&M already completed on few power plants like Kothagudem (4 x 60 MW & 1 x 110 MW), Kota (2 x 110 MW), Neyveli (6 x 50 MW & 3 x 100 MW)
3. LEP studies being conducted through PFC/SEB joint funding; prior to finalising the financial package for R&M.
4. LEP studies conducted by organisations like BHEL, PPIL, NTPC-Alstom Power, GE Power Services Ltd, LMZ Energy, BHEL/GE Gas Turbine Services, Alstom Power India.
5. Status of R&M programmes under APDRP by Ministry of Power, Government of India.

Task No.2:

Criteria matrix developed to assess suitability of SEB power plant for their improvement through ESCO involvement

	Criteria	Plant 1	Plant 2
1.0	Technical (Plant/unit-wise)		
1.1	Capacity (Installed, MW) (Derated, MW)		
1.2	Year of commissioning, operating hours till date		
1.3	Plant availability in a year (%)		
1.4	Plant gross heat rate (Design, kCal/kWh) (Actual, kCal/kWh)		
1.5	Calorific value of fuel (GCV/HHV) (Design, kCal/kg) (Actual, kCal/kg)		
1.6	Status of R&M/RLA studies		
2.0	Financial performance (SEB-wise)		
2.1	Commercial profit/loss (Rs)		
2.2	Rate of return with and without subsidy		
2.3	Average revenue/average cost		
2.4	No. of days (after which dues are) payable on power purchased		

	Criteria	Plant 1	Plant 2
2.5	Debt-service coverage ratio		
3.0	Human Resources (SEB-wise)		
3.1	No. of engineers/ Skilled technicians/Unskilled workers per plant		
4.0	Others (SEB-wise)		
4.1	Restructuring/reform status		
4.2	Credibility among FIs, like WB, KfW, ADB, PFC, IDBI, etc.		

Reasons for selecting each criteria of the matrix to assess suitability of SEB power plant for their improvement through ESCO involvement

	<i>Criteria</i>	<i>Reason</i>
1.0	Technical	
1.1	Capacity (Installed, MW) (Derated, MW)	The difference between the two will give an idea about the derated/ upgraded capacity of the plant. It indicates whether there is a scope for PPI or not.
1.2	Year of commissioning, operating hours till date	All mechanical equipments have specified life depending upon the creep properties of the materials used. This basically mean that with age, the strength of materials reduces. Thus, it is important to look into expended life of the plant while selecting for improvement. As per the guidelines set by CEA, thermal units which have completed more than 20 years of service life or have completed 1,00,000 operating hours are to be taken up for RLA studies and units for more than 25 years of their economical useful life are to be taken up for implementation of LEP.
1.3	Plant availability in a year (%)	Availability gives percentage of time for which plants were under shut down and forced outages. $PA = 100 - FO - PM - SA$ Where, FO = Forced outage unavailability (%) PM = Planned maintenance unavailability (%) PA = Plant availability SA = Scheduled outage (%) The unavailability affects generation reliability and the output of the operating units. The reasons for decrease in the level of availability are; (1) Increase in the level of forced outage unavailability beyond the originally anticipated level (2) changes in the mean time between forced shut downs, (3) extension of planned shut down duration beyond the programme time, and (4) the unavailability due to partial constraints of auxiliaries and equipment in excess of the originally assessed level.
1.4	Plant gross heat rate (Design, kCal/kWh) (Actual, kCal/kWh)	Plant heat rate defines the fuel consumption per kWh of power generated. The comparison of design and actual values will clearly indicate the reduction in energy efficiency of the plant.
1.5	Calorific value of fuel (GCV/HHV) (Design, kCal/kg) (Actual, kCal/kg)	Each boiler is designed to handle efficiently a small range of coal quality. If the quality or calorific value has reduced over time, it will definitely change the efficiency of the plant. Such a situation is a clear indication that plant could be taken for improvement.

	<i>Criteria</i>	<i>Reason</i>
1 6	Status of R&M/RLA studies	There are number of activities identified under R&M (Phase II) programme and additional R&M works have been identified by roving team of CEA/BHEL for Ninth Plan in the year 1997-98. Out of all activities identified, some have already been implemented and some of the activities are still need to be implemented. The activities already implemented or which are no longer need to be implemented may be excluded for future work.
2.0	Financial performance (SEB-wise)	
2.1	Commercial profit/loss (Rs)	It is net surplus/deficit, i.e. gross operating surplus or deficit less depreciation, interest due to institutional creditors and to state governments, i.e. total revenue minus total cost. Due to the difference between the cost per unit of power available for sale and gross revenue realisation, the SEB power plant makes either a profit or loss per incremental unit sold. Most of the SEBs have been booking losses as the price of the power generated is much more than the per unit revenue realised.
2.2	Rate of return with and without subsidy	It is the ratio of commercial profit/loss to net fixed assets, expressed as percentage. The viability of an SEB depends upon the revenue collected (including subsidies from state governments). Even though the rate of return is negative for all SEBs, those having less negative value may be preferred for investments by outsiders (ESCO)
2.3	Average revenue/average cost	Average cost is the ratio of total cost (i.e. revenue expenditure plus depreciation and interest due) divided by total electricity sold. The recovery of costs through revenues is crucial for the health of any organisation. The recovery is actually less than the costs for all SEBs. Reason being subsidized rates for agricultural and domestic users besides high T&D losses/ thefts. So customer profile with respect to industrial customers and subsidized customers has to be examined. This would give a trend whether revenue collection can improve in future or not
2.4	No. of days (after which dues are) payable on power purchased	The number of days payable on power purchase indicates the promptness of the board in clearing its dues. A higher numbers of days payables can be a warning signal for ESCOs. An indicated figure is arrived at by taking the ratio of payables on the power purchase to per day expenditure on the purchase of power. Days payable = $\frac{\text{Payables on power purchase}}{\text{Expenditure on power purchase per day}}$

	<i>Criteria</i>	<i>Reason</i>
2.5	Debt-service coverage ratio	The debt service coverage ratio has been considered to analyse the long-term credit risk of lending money. In this, in addition to the interest payments, repayments of principal are also considered as this would make actual cash outflow in the long run. A ratio greater than unity would indicate a comfortable position of the borrowing entity in terms of servicing debt repayments and interest liabilities. Interest ratio = $\frac{OPBITD^*}{\text{Interest} + \text{repayments due during the year}}$ Some SEBs may have a positive interest coverage ratio but a negative debt service coverage ratio. Such a scenario indicates that even though the board is in a comfortable position as far as interest payments are concerned, it may have trouble servicing its principal repayments. *OPBITD = operating profit before interest tax and depreciation = profit (loss) – subsidy booked + subsidy received + tax + depreciation + interest – interest capitalised
3.0	Human Resources (SEB-wise)	
3.1	No. of engineers/Skilled technicians/Unskilled workers per plant	This will indicate the efficiency of the staff, ie, how professionally the power plant is managed. It will also indicate the level of technical knowledge of the employees (through their engineers) of the plant. (This is however, not compiled separately for generation/ transmission/distribution).
4.0	Others (SEB-wise)	
4.1	Restructuring/reform status	Restructuring/reform aims at making the SEBs financially viable. Thus SEBs moving to reforms will always be preferred by private sector (ESCO). Even Ministry of Power, Government of India is liberal about allocating funds (e.g. APDRP) to states undertaking reforms in power sector.
4.2	Credibility among FIs, like WB, KfW, ADB, PFC, IDBI, etc.	Past track record of SEBs with respect to utilisation/servicing of loans, is also an indication of the capability of management of SEB to take up the projects. Due to these reasons, some of the SEBs are not eligible for availing loans from PFC & WB.

Task 3:

Finalization of criteria matrix

The first draft of the criteria (Task 2) was sent to GTZ on April 8, 2002. Discussions were then held with Mr K C Mahajan, GTZ, New Delhi on April 18, 2002. Based on the comments/suggestions, the criteria have been suitably modified as given in write-up on Task 2.

Task 4:

Overview of data available for SEB power plants

The major publications for the performance of power plants in India are:

1. Performance review of thermal power stations by CEA; last report published for 1996-97, latest report expected in September/October 2002.
2. Annual Report on the working of State Electricity Boards & Electricity Departments by Planning Commission at the time of annual plan development in November/December every year.
3. SEB Financial Report by Power Line Research; last report available is 2000-01.

The source of data for all these publications is the weekly/monthly/yearly data compiled by SEBs.

- 1 The name plate data (installed capacity rating, derated capacity and make of major equipment like boiler and turbine) is recorded yearly.
- 2 The financial data is gathered from SEBs through the annual statement of accounts and questionnaires sent by respective agencies to SEBs.
- 3 The weekly/monthly data on performance of each unit of all power plants of SEB is given by each power station authorities and SEBs to CEA for compilation and publication.
- 4 The Performance Evaluation Division of CEA also conducts few performance audits every year. Their study is included as a chapter in the CEA's publication mentioned above.

This data for each unit is for the following:

- kWh (units) generated
- PLF
- Planned and forced outages (of boiler, turbine, generator, auxiliaries, miscellaneous)
- Loss of generation for each outage
- Coal supply position/shortage
- Oil consumption
- Auxiliary power consumption
- Grid management (frequency variation)

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- Environmental emissions
- Energy audits/conservation measures in progress
- New plants commissioned, if any
- Status of R&M programmes in progress

Task 5:

List of entities collecting and publishing SEB power plant performance data

A. Central Electricity Authority

1. Mr C M Bhogal (For operation performance data)
Chief Engineer
Operation Performance Monitoring Division
Sewa Bhawan, R K Puram
New Delhi – 110 066

Tel: 6108476/6105619
Website: www.cea.nic.in

2. Mr T G Srinivasan (For financial performance data)
Member
Economic and Commercial Wing
Sewa Bhawan, R K Puram
New Delhi – 110 066

Tel: 6108476/6105619
Website: www.cea.nic.in

B. Planning Commission (Government of India)

Mr P K Mohanthy
Principal Advisor Energy
Power & Energy Division
Yojana Bhawan, Sansad Marg
New Delhi – 110 001

Tel: 3716353 (D), 3715481 extn. 2209
Fax: 3717681, 3725491
Website: www.planningcommission.nic.in

C. Council of Power Utilities

Mr C V J Verma
Secretary General
A-2/158, Janak Puri
New Delhi – 110 058

Tel: 5618472/5556196
Fax: 5611622
e-mail: cvj@vsnl.com
Website: india-power.org

D. Power Line Research

(A division of India Infrastructure Publishing Pvt Ltd.

Mr Sunil Puri
D-4/5, Second Floor
Vasant Vihar
New Delhi – 110 057

Tel: 6152322/6159120/6159130
Fax: 6152344
e-mail: powerlin@del2.vsnl.net.in
Website: www.indiapoweronline.com

5.1 Central Electricity Authority (CEA)

One of the functions of the CEA constituted under section 3 of the electricity (supply) act 1948 is to collect and record the data concerning generation, distribution and utilization of power, and carry out studies relating to cost, efficiency, losses, benefits and such like matters, and to make available to the public from time to time information secured under this act and to arrange for the publication of the reports and investigations.

5.1.1 Operation performance data

The data pertaining to operation and technical/physical performance of power plants is collected directly from power station authorities (plants), all state electricity boards (SEBs), public sector corporations and private utilities. The most of the information is obtained in hard copy as few SEBs have been computerised. The various operational data such as, unit-wise generation (peak generation and auxiliary consumption), unit-

wise outages (day in, day out, time in, time out, and reason for outages) and partial loss data (loss and its reasons) is collected. The unit-wise generation and coal consumption data is obtained on a daily basis from the power plants. It is also put on CEA's website on daily basis. CEA analyses this data and publish in a report (Performance Review of Thermal Power Stations) form, which contains the following information:

- Unit-wise performance indices of thermal power stations in the country, such as plant load factor, planned maintenance, forced outage, operating availability factor, partial loss, shut down reserve and low load factor. The performance of the thermal units considered is also arranged by capacity group-wise/make-wise/sector-wise and region-wise. These performance indices are available in a particular years report for last 3 years for comparison and investigation.
- The average duration (days) in respect of boiler overhaul, capital overhaul and long duration forced outage. The unit-wise details of boiler overhaul, capital overhaul and long duration forced outage (more than 25 days)
- The station-wise/organization-wise secondary fuel oil & coal consumption for the last 4 years and auxiliary power consumption for the last 5 years.

The report on the performance of thermal power stations for a period of 1996-97 was published in July 1999 and latest report-containing data up to 1999/2000 is under printing.

5.1.2 Financial performance data

The economical and commercial wing of the CEA collects financial performance data of SEBs and also publishes it in a simplified manner from time to time. The accounting system followed by various Boards in the SEBs has been of diverse pattern. With effect from 1.4.1985 the SEBs are required to prepare the annual statement of accounts as per the Electricity (supply) Rules 1985. All SEBs have started submitting their annual statement of accounts in manner prescribed under the rules. CEA publishes report on the financial performance of SEBs from time to time. A report on the financial performance of SEBs for a period of 1991-92 to 1994-95 contains the following:

- | | |
|---------------------------|--|
| ▪ Surplus/deficit of SEBs | ▪ State electricity duty |
| ▪ Subsidy | ▪ Sale of electricity to agriculture sector |
| ▪ Rate of return | ▪ Sale of electricity to domestic sector |
| ▪ Outstanding loans | ▪ Gap between realisation and cost of supply |
| ▪ Equity participation | |
| ▪ Plant load factor | |
| ▪ T&D losses | |

5.2 Planning Commission

Power & Energy Division of Planning Commission collects every year, at the time of preparation of Annual Plan of the country, the data pertaining to physical as well as financial performance of power plants from CEA, state electricity boards (SEBs), public sector corporations and private utilities. It publishes a report on the working of state electricity boards & electricity departments (EDs) annually which covers:

- Overview of the Indian electricity sector indicating the major issues concerning power sector for the country as a whole
- Plan outlays and expenditures by the State/Union Territories.
- Physical performance of the SEBs and EDs. It covers details regarding installed capacity and its mix, generation, capacity utilisations viz. plant load factor, forced outages, auxiliary consumption and other indicators like power purchased from other agencies, T&D losses, sales to consumers etc.
- Analysis of important financial parameters such as cost of supply and its components, average tariff realized, average and consumer category-wise tariff realized, and other indicators such as commercial profits and losses, subsidy provided to domestic and agricultural consumers and cross-subsidization from other consumers, rate of return on capital employed, net internal resources, arrears, outstanding dues, etc. for the SEBs and EDs.
- Status of reforms in various states.
- State-wise breakup of gross/net operating surplus, depreciation, interest payable to the institutional creditors as well as State Government and the commercial losses.
- Break-up of subsidy to agricultural and domestic consumers, subvention received from the State Government, surplus generated by way of cross-subsidization from other sectors and the uncovered subsidy.

The information provided in the annual report is not generally based on audited reports of the SEBs as the accounts of SEBs are audited with a considerable time lag.

5.3 Council of Power Utilities

Council of Power Utilities (CPU), an umbrella organization of power utilities in India, established in 1983, aims at formulation of solutions of problem besetting the power supply industry through interaction between indigenous utilities and also between utilities of developed and developing countries. They collect data from SEBs, public sector corporations and private utilities on monthly/yearly basis. Sometimes monthly performance parameters of selected thermal power stations are published in their quarterly journal (India Power). The Council has also

published a report on performance of SEBs in India (1992-93 to 1995-96) which contains the following information:

- Actual financial performance data of 17 SEBs during first four years of Eighth Plan.
- Cost/revenue return scenario and aspect of the gap between the two on physical performance of SEBs
- Analysis of operating cost components
- Identification of different causes of financial loss of SEBs.

5.4 Power Line Research

Power Line Research is a division of India Infrastructure Publishing Pvt Ltd. They collect data directly from SEBs, public sector corporations and private utilities and ministries through questionnaires on monthly/yearly basis. The analysis of the up-to-date data on physical and financial performance of power plant is published in form of different reports as given below:

- The SEB Report
- The SEB Financial Report

5.4.1 The SEB Report

It provides a detailed and updated profile of each SEB and private utility with information on:

- | | |
|-------------------------|--|
| ▪ Existing capacity | ▪ Employee counts |
| ▪ Proposed projects | ▪ Latest tariffs |
| ▪ Generation/purchase | ▪ Key personnel/contact information |
| ▪ Demand projections | ▪ Customer profile |
| ▪ Physical performance | ▪ Reform and restructuring efforts of each SEB |
| ▪ Transmission network | |
| ▪ Sales history | |
| ▪ Financial performance | |

5.4.2 The SEB Financial Report

The report provides a detailed financial analysis for each SEB. It covers:

- Balance sheet
- Revenue statement
- Source/uses of funds
- Income/expenditure
- Revenue realisation
- Debtors/creditors
- Subsidies
- Debt-equity structure
- Liquidity

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- Profitability/Rate of return
- Interest/debt service coverage
- Cost of generation
- Fuel costs
- Power purchase
- Receivables/payables
- Operational characteristics

Task 6:

Presentation and discussion of list of data provider

This subject has been discussed with Mr K C Mahajan, GTZ, New Delhi. The suggestions given have been incorporated in the draft write-up for Task 5.

Task 7:

Assessment of SEB power plant data provider

There are four data providers/compilers collecting and publishing physical and financial data of SEB power plants. Each data provider collects data directly through power station authorities (plants) and state electricity boards (SEBs) through questionnaires. Therefore, quality of the data provided by all of them is reliable within the limits of correctness of the data reported by SEBs, who also have certain limitation of exactness due to operating conditions at site.

7.1 Physical data

The physical performance data is provided by CEA, Planning Commission and Power Line Research. The unit-wise physical performance data is collected and published only by CEA while others give physical performance data SEB-wise. The physical performance data of power plants provided by all of them is matching.

7.2 Financial data

The financial performance data is provided by all the four data providers, viz., CEA, Council of Power Utilities, Planning Commission, and Power Line Research. The CEA and Council of Power Utilities do not publish financial performance data of SEBs on annual basis. The latest report published by them contains data upto 1996-97.

The Planning Commission and Power Line Research publish reports annually containing financial performance data of SEBs. The Planning Commission publishes latest estimates for the current year and these figures may undergo some modifications as and when the financial statement of SEBs are audited and updated. Discussion with Mr L P Sonkar, Joint Adviser, Energy, revealed that they have annual plan resource discussion with SEBs every year in November to estimate the financial resources of SEBs for the current year. The information is collected through questionnaires. Therefore, the report published by Planning Commission contains latest estimates for the current year and annual projections for the next year.

7.3 Plan funds for Capital Budget and Power Plant Improvement (PPI/R&M)

The Annual Plan (Capital) Funds requirements are prepared in detail by each power station for each of their units for major overhauls, modifications/additions, and R&M/PPI works. This is then put up to their SEBs who compile and forward the same to their state governments for inclusion in the state's requirements to be presented before the Planning Commission. Since the country's resources are limited, the funds allocation by the Commission is less as compared to demands. Keeping that in view, the power stations generally inflate their estimates. However, Department of R&M (DRM), CEA does scrutinize these estimates for R&M/PPI works.

Task 8:

Assessment of quality of data provided

The data on the performance of all power plants of SEBs is compiled by their Head Office for generation, transmission and distribution. The Head Office also keeps a record of power purchased from private sector sources, and the fuels (coal/furnace oil/LDO) supplied to all power stations. All revenues collected from the sale of electricity are centralised. The Head Office directly makes the payments for the fuels and the power purchased. The generating stations operate on budgetary allocation basis for their manpower, maintenance, and other sundry expenses. The expenses required for major changes and modification are allocated to their stations by SEB from their capital funds resources, also called the Plan Funds. These are mainly from the Planning Commission allocation from Central Government and the State Government. The power plants provides daily and monthly data to its Head Office on the following:

1. Units generated, kWh
2. Shut-downs (planned and forced)
3. Coal supply source and quantity received/used
4. Fuel oil & LDO consumption
5. PLF (till date, for the year)

The items 3 & 4 are generally for the whole station. Rest of the data is unit-wise. Wherever the gravimetric feeders for coal have been installed, the data is given unit-wise for item 3.

The data on power supplied and billed, and the revenue collected is compiled by the T&D departments of SEBs and given to their head offices. The State Government subsidies (if any) for the power supply also collected by the SEBs Head Office.

The financial data and the profit-loss account of each SEB are prepared monthly by the head offices of SEBs.

The quality of data provided by State Electricity Boards to CEA is good and reliable in some cases, whereas it is not so in some cases.

8.1 Performance of power plants

8.1.1 *Electricity generated and auxiliary power consumption*

This data is generally authentic and is based on the energy meters provided at the plant particularly for the power despatched. The auxiliary power is also recorded in the logbooks. This data is also authentic as it is available on meters provided in the control room.

8.1.2 *Shut downs*

The data from the logbooks for the planned and unplanned shut downs (leading to calculation of plant availability) is also correct, as it comes from the logbook on the operation of the plant.

8.1.3 *Coal consumption*

The coal consumption data is generally not very correct. Many times, coal is received from more than one mines and the supplies are not stacked separately. The consumption value given is for the power plant as a whole and not unit-wise. This figure too is arrived at based on coal received at the station minus the stock available. Since the coal is not stacked scientifically, it is not possible to estimate the stock of coal correctly,

Thus, the unit-wise or plant-wise consumption figure for the coal is not correct, except for the new units where gravimetric feeders (with integrators) for the coal flow measurement have been provided.

8.1.4 *Gross calorific value of coal*

Even when there are definite linkages of coal mines with the power station, the coal supply is not consistent. Moreover, the supplies received are stacked and reclaimed through reclaimer conveyor. Thus, the coal fed will be of some kind of mixture of coal received on different days. The feed composition is not monitored (through lab tests) every day unit-wise. Thus, the calorific value will be just on average and will not reflect accurately the specific fuel consumption (coal per kWh of power generated).

Discussions with CEA revealed that due to this reason, the practice of reporting the actual heat rate (kCal/kWh) of the power plant and its comparison with the design heat rate has been discontinued since early nineties. This data is not given now in the reports of CEA on thermal power plants.

8.1.5 Station heat rate

The station heat rate (SHR) data is also monitored by the Performance Evaluation Division of CEA for instituting an incentive scheme for improved SHR. The data reported by the power stations is considered if various parameters such as calorific value of fuel, power generation, fuel consumption have been recorded by the station on monthly basis. Sixty one such plants have been analysed in 1996-97, and the number in 2001-02 has been reduced to 39.

The SHR data for such stations can be considered reliable as compared to that done by averaging the fuel consumption yearly, and can be used for relative comparison between different stations having similar rating units. However, the data would have been most reliable if it is based on monthly tests for boiler efficiency as per ASME PTC-4 and the heat rate of the TG set.

8.1.6 Status of R&M/RLA study

The information on R&M work carried out in different power plants during Ninth Five Year Plan is given in various documents on power plants, the most important among these documents is the National Perspective Plan for Renovation and Modernization of Thermal Power Plants (upto 2012). However, the latest update on the status of the R&M/RLA studies can be obtained from the renovation and modernization division of CEA, there is no practice of publishing it periodically.

8.2 Financial parameters

With effect from 01.04.1985, the SEBs are required to prepare the annual statement of accounts as per the Electricity Supply Rule 1985. Each SEB thus prepares annual statement of accounts which contains information on their financial performance. The information published in various documents of CEA/ Council of Power Utilities/Power Line Research is from the annual statement of accounts of SEBs. Since the accounts of many SEBs are audited with a considerable time lag, the information provided in the annual statement of accounts is not always based on the audited reports and may undergo some

modifications as and when the financial statements of the SEBs are audited and updated.

8.3 Human Resources

Information regarding technical/non-technical staff is obtained from the respective SEBs annual statement of accounts. However, the break-up of manpower for generation, transmission and distribution is not available. Thus, the details of the staffing of the power generating plants is not available, and it is not possible to judge whether the plant has adequately qualified staff. Therefore, the data is insufficient for proper analysis.

8.4 Others

8.4.1 Credibility of SEB among financial institutions

This information is also not available in the public domain and can be obtained from the respective financial institutions only.

Physical performance data of SEB power plants

[illegible]

Name of road	No.	Intersecting Agency (MMS)	Intersecting Agency (MMS)	Date of Construction	Point of Intersection	Intersection Type	1977-88	1989-92	1993-2000	2001-02	2003-04	1996-8	1997-98	1999-00	1999-2000	Average	7/27/01	1991-94	1995-96	1997-98
OSRA Thermal	5	50.0	40.0	3007/1971	47.26							55.08	56.84	56.83	16.27	33.76				
OSRA Thermal	6	100.0	84.0	04/10/1973	0.00							0.00	7.89	47.61	40.68	24.05				
OSRA Thermal	7	100.0	84.0	04/12/1974	44.81							24.17	9.11	0.00	22.71	14.00				
OSRA Thermal	8	100.0	84.0	15/09/1975	53.81	2818.61	3443.0	22.16	3410.0	20.88	3396.0	20.46	3094.0	9.77	2977.0	3.85				
OSRA Thermal	10	200.0	200.0	14/01/1979	75.34							36.82	3.71	27.17	57.02	31.18				
OSRA Thermal	11	200.0	200.0	31/12/1977	0.00							0.00	11.30	11.70	63.18	21.66				
OSRA Thermal	12	200.0	200.0	28/02/1981	69.42							48.02	58.07	0.70	40.87	37.17				
OSRA Thermal	13	200.0	200.0	21/07/1982	52.36	2828.00	2800.0	10.02	3201.0	21.43	3446.0	30.73	3853.0	8.23						
OSRA Thermal	1	32.0	32.0	01/10/1967	0.00							0.00	0.00	0.00	0.00	0.00				
OSRA Thermal	2	32.0	32.0	14/07/1968	47.27							29.26	1.97	0.00	0.00	7.56				
OSRA Thermal	3	110.0	105.0	10/11/1978	86.78							34.96	35.06	28.12	60.34	30.63				
OSRA Thermal	4	110.0	105.0	24/02/1977	75.90							47.29	55.29	52.62	29.35	48.14				
OSRA Thermal	1	80.0	40.0	01/02/1968	0.00							0.00	11.08	39.56	13.98	16.25				
OSRA Thermal	3	80.0	80.0	22/01/1972	75.33							40.81	21.64	7.04	15.60	23.81				
OSRA Thermal	4	80.0	80.0	18/09/1972	42.42							32.34	60.04	29.16	30.03	36.29				
OSRA Thermal	5	80.0	80.0	21/02/1977	64.15							43.97	39.38	26.07	4.57	28.40				
OSRA Thermal	6	80.0	80.0	11/08/1977	0.00							0.00	0.00	0.00	0.00	0.00				
OSRA Thermal	7	110.0	105.0	28/02/1978	0.00							0.00	0.00	28.02	30.44	14.62				
OSRA Thermal	1	110.0	110.0	31/02/1984	0.07	2479.34	4448.0	79.28	4580.0	85.13	4281.0	71.80	3814.0	38.27						
OSRA Thermal	2	110.0	110.0	25/02/1985	72.31	2479.34	4448.0	79.28	4580.0	85.13	4281.0	71.80	3814.0	38.27						
OSRA Thermal	1	210.0	210.0	24/02/1986	88.10							65.83	38.97	30.18	20.03	37.00				
OSRA Thermal	2	210.0	210.0	28/02/1987	88.88							60.45	71.62	82.35	64.52	74.74				
OSRA Thermal	3	210.0	210.0	02/12/1988	87.53							77.00	70.23	70.51	56.94	68.47				
OSRA Thermal	4	500.0	500.0	18/07/1993	88.96							78.84	71.64	60.72	67.19	69.40				
OSRA Thermal	5	500.0	500.0	04/07/1994	80.50							82.03	45.79	81.26	82.15	65.46				
OSRA Thermal	1	110.0	110.0	21/02/1985	88.51	2358.18	2739.0	16.15	2644.0	13.72	2662.0	12.86	35.85	27.40	14.32	27.52				
OSRA Thermal	2	110.0	110.0	11/02/1986	65.16							37.61	16.18	20.34	35.28	27.30				
OSRA Thermal	3	110.0	110.0	28/02/1990	55.47							38.13	50.12	30.00	5.50	30.64				
OSRA Thermal	4	484.0	484.0		62.11															
OSRA Thermal	1	63.5	63.5	01/07/1985	69.56							78.56	68.08	57.71	55.55	64.23				
OSRA Thermal	2	63.5	63.5	01/04/1985	86.33							72.81	66.34	57.52	48.72	61.35				

Financial performance (SEB-wise)

State	Profit/Loss (with subsidy)		Profit/Loss (without subsidy)		RoR (with subsidy)		RoR (without subsidy)		Payables (no. of days)		Receivables (no. of days)		Payables/Receivables		DSCR		ICR		PLF (%)		T&D losses (%)	
	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00	1998-99	1999-00
Andhra Pradesh*	1126.0	(-12286.4)	(-12407.0)	(-13293.2)	3.0	3.0	(-126.0)	(-128.0)	241.2	71.0	127.0	99.3	1.90	0.72	-0.1	-0.8	4.2	(-13.4)	77.6	83.1	31.8	36.9
Assam	(-13072.5)	(-13650.7)	(-14395.2)	(-17474.0)	(-140.1)	(-176.4)	(-145.5)	(-182.2)	454.2	630.1	406.7	376.4	1.10	1.67	-0.8	(-1.54)	-1.0	(-1.86)	20.5	17.3	23.2	41.8
Bihar	(-13268.8)	(-13920.4)	(-110340.4)	(-16210.4)	(-122.7)	(-163.6)	(-171.9)	(-180.6)	236.1	396.1	394.4	427.5	0.93	0.93	-1.2	(-10.83)	-2.5	(-11.00)	15.0	23.9	23.0	31.0
Chhattisgarh	(-13563.1)	(-18339.3)	(-1470.0)	(-18339.3)	(-126.0)	(-147.0)	(-187.0)	(-170.0)	NA	640.2	489.8	561.1	NA	1.14	NA	NA	(-11.00)	44.0	55.0	46.3	47.5	
Gujarat*	(-13834.7)	(-122085.8)	(-120566.4)	(-13594.5)	(-19.1)	(-154.6)	(-148.9)	(-186.9)	81.0	88.6	93.0	102.3	0.90	0.87	-0.6	(-10.57)	-1.0	(-10.97)	63.0	66.7	19.7	20.5
Haryana**	(-12741.7)	(-15313.4)	(-13707.0)	(-18047.5)	(-16.2)	(-16.2)	(-24.9)	(-24.8)	149.5	123.2	92.5	73.8	1.60	1.67	-0.3	(-10.57)	-1.0	(-10.97)	63.0	66.7	19.7	20.5
Himachal Pradesh	(-192.7)	(-11062.0)	(-182.7)	(-11062.0)	(-1.0)	(-15.4)	(-11.0)	(-15.4)	276.6	241.3	73.7	78.0	3.80	3.09	0.6	(-10.39)	1.4	(10.62)	56.6	45.4	20.1	21.5
Jammu & Kashmir	(-18654.8)	(-18687.3)	(-16654.8)	(-16687.3)	(-15.1)	(-15.2)	(-15.1)	(-15.2)	NA	NA	NA	NA	NA	NA	-3.1	(-13.20)	4.0	(-14.10)	22.1	40.3	47.1	47.0
Karnataka	669.9	757.1	(-17925.0)	(-11363.9)	3.0	3.0	(-35.5)	(-45.0)	169.1	188.7	195.2	160.9	0.90	1.17	NA	0.40	1.3	0.78	82.0	81.2	30.1	38.0
Kerala	387.5	441.3	(-12629.6)	(-12682.4)	3.0	3.0	(-120.3)	(-118.6)	46.1	54.1	148.0	146.0	0.30	0.37	0.1	0.19	0.5	0.46	51.0	52.0	18.0	17.0
Madhya Pradesh	1169.3	(-113713.0)	(-116067.2)	(-116844.1)	3.0	3.0	(-141.2)	(-135.1)	218.1	278.4	176.2	175.1	1.20	1.59	-0.3	0.50	0.5	0.82	68.2	69.5	20.9	31.6
Maharashtra	3761.5	47.1	210.1	(-12798.9)	4.5	4.5	0.3	(-118.8)	387.0	41.4	145.6	167.5	0.30	0.25	1.0	0.35	2.0	0.64	67.5	71.8	17.2	34.8
Meghalaya	(-1232.9)	(-)	(-1322.9)	(-1299.5)	NA	NA	(-116.4)	(-115.7)	477.3	513.4	680.0	704.6	0.70	0.73	0.5	0.69	0.8	0.82	34.2	39.1	20.1	20.6
Mizoram**	(-13191.2)	1	(-13244.3)	(-1243.9)	NA	NA	NA	NA	273.5	62.2	136.0	71.4	0.80	0.87	NA	0.28	-1.5	(-1.52)	75.8	71.2	NA	NA
Nagaland	509.1	4	(-18769.7)	(-12410.8)	2.1	0.13	(-136.0)	(-135.7)	58.3	62.2	71.4	71.4	0.80	0.87	-0.1	0.28	-1.5	(-1.52)	75.8	71.2	NA	NA
Odisha	659.0	9	(-11306.6)	(-16870.5)	3.0	3.0	(-151.5)	(-155.7)	71.3	118.3	125.2	127.2	0.60	0.93	0.3	0.17	0.4	0.39	68.4	81.4	17.8	18.0
Tamil Nadu	3349.4	3	(-17412.8)	(-14201.4)	5.8	5.7	(-112.7)	(-122.8)	82.6	66.3	95.2	86.4	0.90	0.77	0.7	0.20	2.6	0.50	65.6	72.3	17.0	16.7
Uttar Pradesh****	2916.4	(-11	(-15479.7)	(-1518.0)	2.9	4.11	(-115.5)	(-117.5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	49.1	50.5	26.8	28.6
West Bengal	(-17177.9)	(-15	(-19041.5)	(-10288.2)	(-102.0)	(-180.0)	(-128.6)	(-141.1)	395.2	550.7	273.0	289.5	1.40	1.84	-1.3	(-1.56)	2.1	(-2.46)	36.6	40.0	18.3	37.9

* profit/loss data for 1999-00 includes figures for AP Genco and AP Transco

** profit/loss data for 1999-00 includes figures for HPCL, HPCL and UHBVN

*** profit/loss data for 1999-00 includes figures for OPSC only (OPSC booked Rs 552.1 million profit in 1998-99)

Plan of Operations, TERI/IGEEP/3/18

Deutsche
Gesellschaft für
Technische
Zusammenarbeit
(GTZ) GmbH

Project title: GENEFF
Result: Data Collection for GENEFF Fact Finding Mission

Planning period: March 25 through May 1, 2002
Prepared on: March 18, 2002

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No.	Activity	Indicator/ interim result	Days after contract signing/											Responsibility	Personnel requirements (days)	Costs of Services	Assumptions/ remarks
			5	10	15	20	25	30	35	40	45	50	55	60			
1	List of previous studies about SEB power plant prepared.	List submitted to BEE/IGEEP	X												TERI		0 List must include title of study, authors, year of publication, publisher and availability
2	Criteria matrix developed to assess suitability of SEB power plant for ESCO involvement	Draft presented to BEE/IGEEP and discussed in meeting	X												TERI		The objective is to characterize SEB power plants to what extent they could be a suitable future candidate for performance contract.
3	Selection criteria matrix agreed upon and finalized	Final document approved by BEE/IGEEP		X											TERI		The criteria matrix must for each criteria include a justification why this criteria is important.
4	Overview of data available for SEB power plants prepared	Table presented to BEE/IGEEP for discussion	X												TERI		Table must distinguish between name plate data collected once and performance data collected periodically
5	List of entities collecting and publishing SEB power plant performance data	List presented to BEE/IGEEP			X										TERI		Complete address and name of contact person as well as what date they collect.
6	Presentation and discussion of list of data provider.	Meeting with TERI and BEE													TERI		For each entity listed, sample of how they report data must be attached to list.
7	Assessment of SEB power plant data provider	Meeting with TERI and conclusions. Report		X											TERI		Report must include why certain data providers may have only secondary or unreliable data and why others have original better data.
8	Assessment of data quality provided.	List of data (item 4) is taken as a basis for data quality assessment		X											TERI		Justification why data quality is already good or bad, or how questionable data could be improved should be provided
9	Available performance data of SEB power plants encoded in EXCEL spreadsheet	Spreadsheet provided			X	X	X	X	X	X	X	X	X		TERI		There is no original data collection necessary. Only presently available data should be listed

